PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference RSJ07963WO	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/GB2004/004457	International filing date *(day/month/year)* 21.10.2004	Priority date *(day/month/year)* 22.10.2003
International Patent Classification (IPC) or national classification and IPC G01R33/385		
Applicant OXFORD INSTRUMENTS PLC et al.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 9 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 4 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☒	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
11.08.2005	26.09.2005
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/GB2004/004457

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

   Description, Pages

   1-22 as originally filed

   Claims, Numbers

   1-19 received on 11.08.2005 with letter of 10.08.2005

   Drawings, Sheets

   1/8-8/8 as originally filed

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☒ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☒ the claims, Nos. 20,21
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-19
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-19
Industrial applicability (IA)	Yes:	Claims	1-19
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V.

1 The following documents are referred to in this written report.

D2 = US 2002/0171424
D4 = US 6,208,140
D5 = US 6,297,635
D8 = US 6,515,479

2 Lack of novelty and/or an inventive step (Art. 33(2) and 33(3) PCT)

2.1 Independent claims 1, 13

a) The subject-matter of claim 1 would appear to lack novelty with respect to each of the documents D2, D4, D5 and D8 for the following reasons.

For instance, document D2 discloses (references in parentheses referring to D2):

A method of operating a magnetic resonance apparatus in which magnetic gradient coils are used to generate one or more magnetic field gradients in a working volume (see par. [0013]) so as to define regions (DSV1 and DSV2, respectively, see par. [0035]) from which magnetic resonance signals are obtained in use from a target material (implicitly disclosed by referring to "magnetic resonance imaging", see par. [0013]), the method further comprising that

- a set of at least two magnetic gradient coils is provided for producing the magnetic field gradient in a particular direction (the gradient coil assembly includes a base gradient coil and a correction gradient coil, see par. [0035]) and that

- for each of the defined regions, the one or more magnetic field gradients are controlled in accordance with the position of the said region with

respect to the gradient coils by controlling the ampere-turns values within the at least two coils of the set independently, so as to apply one or more magnetic field gradients of predetermined uniformity within the region (see pars. [0035]-[0039] teaching to adjust the current applied to the correction gradient coil such that DSV2 is tailored to the region being imaged).

Moreover, D2 discloses an apparatus for carrying out the method as well (see pars. [0010], [0011]). Therefore, the lack of novelty holds also for claim 13.

In a similar way, the lack of novelty can be shown with respect to each of the documents D4, D5 and D8 (see e.g. the passages of these documents cited in the search report).

Arguments put forward in the letter of reply dated 10.08.2005

With respect to D2, the Representative argued in his letter of reply that (i) the "correction coils of D2 are not magnetic gradient coils" since they do not produce a first order gradient field, that (ii) the coils of D2 are "not controlled in accordance with the position of the region with respect to the coils" and that (iii) the "current within the correction coils of D2 is not dependent upon the position of the regions used for obtaining MR signals" (page 2, 4th par.).

However, while it is true that the correction coils of D2 do not produce a constant gradient, they do produce third order and higher order gradient fields (see D2, par. [0035]). Therefore, the correction coils according to D2 are to be considered as "magnetic gradient coils". With respect to (ii) and (iii), it is noted that par. [0036] of D2 clearly states that the correction coil "generates ... a gradient field ... so as to increase/expand the useful imaging volume from DSV1 to DSV2". However, compared to sole imaging of region DSV1 (during which no current is applied to the correction coil, see Table 1), the latter statement implies that the current in the correction coil is altered when imaging of region DSV2 is to be performed. Moreover, since region DSV2 may be larger than region DSV1 (see par. [0035]), the position of region DSV2 can be considered to be different from that of region DSV1. Therefore, the current in the correction coil actually

can be considered to be "controlled in accordance with the position of the ... region with respect to the gradient coils" as defined in claims 1 and 13, respectively.

A similar argumentation applies to D4, D5 and D8 as well.

Moreover, with respect to D4, D5 and D8, the Representative argued in his letter of reply that the arrangements disclosed in each of said documents result in a trade-off between gradient field quality and switching speed while "in the present invention neither linearity nor FOV is changed" and "a better FOV specification for a given coil size is provided". However, since claims 1 and 13, respectively, do not contain such limitations, these features cannot be taken into account when comparing the subject-matter of claims 1 and 13 with the prior art.

b) Moreover, even if claim 1 was limited by specifying that each of the at least two magnetic gradient coils produces a constant gradient, amended claim 1 would still appear to lack novelty with respect to each of the documents D4, D5 and D8 (see the passages of these documents cited in the search report).

2.2 Dependent claims 2-12, 14-19

Claims 2-4, 6-8, 14

The additional features of claims 2-4, 6-8 and 14 are known from the prior art as well (see e.g. D2, pars. [0035]-[0040]).

Claims 5, 15-19

Taking the objection under item 4.3 given below into account, the additional features of claims 5 and 15-19 can be considered to be known e.g. from D8 (see fig. 1).

Claims 9-12

The additional features of claims 9-12 would not appear to define more than standard requirements for magnetic field gradients used in MRI. Therefore, it is considered that

these features are implicitly disclosed in each of documents D1-D9 by referring to "magnetic resonance imaging" (see the passages of these documents cited in the search report).

Re Item VII.

3 Certain defects

3.1 According to Rule 5.1a (ii), documents D1-D9 should have been identified in the description and briefly discussed.

3.2 According to Rule 6.2(b) PCT, reference signs should have been added to the claims.

3.3 The description should have brought in conformity with the claims.

Re Item VIII.

4 Lack of clarity and support by the description (Art. 6 PCT)

4.1 Claims 1, 13

a) The broad scope of the wording "gradients are **controlled in accordance** with the position of ... said region with respect to the gradient coils" would not appear to be supported by the description. The description merely supports one particular way of controlling the gradients that involves adjusting the currents in the individual gradient coils such that the **conditions on page 15** of the description are met for the selected slice position. Therefore, it would have been appropriate to add the features of claims 9 or 11, respectively, to claim 1.

b) The wording "to generate ... gradients in a working volume **so as to define** regions from which mr signals are obtained" is obscure since the application of sole magnetic field gradients does **not at all** "define regions from which mr signals are obtained". For instance, when performing slice selection, the region

being imaged is not defined by the slice selection gradient alone, but depends on properties of the rf excitation as well (bandwidth and center frequency of the excitation pulse, etc).

In his letter of reply, the Representative argued that "a skilled addressee is aware of other factors for defining the region and does not need to be told them". However, since the main concept of the present invention is to adapt gradients to the regions being imaged, a clear specification **how the regions are actually defined** would appear to be inevitable.

c) The expression "**position** of the said region with respect to the gradient coil**s**" is unclear since "the gradient coils" represent spacious structures and no particular point of reference such as the isocenter of the gradient coils is defined.

Moreover, referring e.g. to a cylindrical gradient coil set wherein x-, y- and z-gradient coils are provided on respective **nested** cylinders, it is obscure what is to be understood by said expression since the distance of a particular point depends on whether the x-, y- or z-gradient coils is considered as a reference.

d) The scope of the wording "predetermined uniformity" is unclear. Therefore, the "predetermined uniformity" should have been defined more precisely.

e) Concerning claim 1, the additional features of claim 4 would appear to be essential in order to achieve the desired technical effect of "increasing working region volumes" (page 4, lines 13-18 of the description). Therefore, it would have been appropriate to add the corresponding features to claim 1.

Even if, as suggested in the letter of reply, the "benefits of the invention are also provided within regions closer to the centre of the wording volume", the desired technical effect remains the one given above, namely to increase working region volumes. In this context, it is noted that this object is (at least implicitly) mentioned at various passages of the description (page 4, l. 13-18; page 14, l. 25-29; page 17, l. 25 to page 18, l. 4; par. bridging pages 19 and 20, etc).

Hence, the features of claim 4 would still appear to be essential in order to achieve the desired technical effect.

4.2 Claim 2

In patent claims, the term "substantially" is normally used in order to make clear that a parameter may deviate from a target value by a certain amount (e.g. substantially orthogonal). However, with respect to the intersection of two volumes, only **two discrete possibilities** exist, namely the volumes intersect each other or not. Therefore, the scope of the wording "**substantially** intersects" is unclear since and it is obscure which technical limitation is to be defined by said wording.

4.3 Claims 5, 15

As far as they can be understood, claims 5 and 15 would appear to be directed to the embodiment comprising a single-sided arrangement as depicted in fig. 3. However, the wording "working volume is arranged on **one side** of the coils" does not define clear limitations and even the cylindrical arrangements such as those disclosed e.g. in D4 can be considered to have a working volume arranged on one side of the coils (that is the inside area of the gradient coils depicted in fig. 2 of D4 forms the "working volume" while no working volume is arranged on the outside of the cylindrical coils). With respect to the arguments put forward in the letter of reply, it remains unclear why the reference to "one side" rather than to "a side" implies that "something cannot be surrounded".